

Comparison of Gully Erosion in two Different Climatic and Land Use Conditions in the Central Iran, Markazi province

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1. Abstract

Water erosion as the dominant type of land degradation worldwide plays an important role in producing sediment and damaging infrastructures and landuses in Central Iran. Field observations and measurements by different researchers indicated that the causes of gully erosion and characteristics of gullies are not similar in different climatological conditions. In this research, gully erosion with an area larger than 5 km² was determined using anecdotal and historical evidences and intensive field surveys. The climate of the regions affected by gully erosion was determined using De-marton's method. In each climatic zone, two regions with gully erosion and within each region three representative gullies were selected for measuring their characteristics.

To investigate this subject in Markazi Province two climatic zones, mediterranean moderate zone with Solab and Deh-kaeed as representative regions and desertic arid zone with Robattork and Peak Zarand as representative regions were selected. In each region the morphometric characteristics, soil and morphology of selected gullies were measured. This paper aims at comparing the characteristics of gully erosion in two climates.

The results indicated that the desertic arid region had low rainfall and soil structure is weak. Also the amount of EC, ESP, SAR and alkalinity were in high level. This arid climate experienced larger area and more dense gully erosion. In this climatic condition, human impact is more obvious on the incidence of gully erosion. Gullies in the desertic arid climate are longer with general dendritic view plans and vertical head plans. Most of the gullies were formed in the rangelands.

In the mediterranean climate as the humid condition, gullies experiencing linear view plan on the plateaus and upper terraces were formed on the croplands with higher rainfall. Usually the length of the gullies are smaller than arid climates but their width and depths are higher than arid zones.

The results imply that ecosystems in arid zones are more prone to gully formation and development due to less vegetation cover and increasing bare land area. In the case of gully erosion, a combination of control measures are needed and applying only structural measures would not be successful. In humid regions, due to higher rainfall and better soil characteristics, management and vegetative measures should be prioritized.

Key Words: gully erosion, climate, markazi Province.

2. Introduction

Gullies are relatively permanent steep sided water resources which experience ephemeral flows during rainstorms (Morgan, 1995). Gully erosion causes severe damage to agriculture and constructed sites such as bridges, roads and settlements. As well as the on site damage, off site effects of gully erosion include the siltation of rivers and reservoirs. Comparison of gullies in different climates and soil characteristics is made by Poesen et al. (2003). A national research plan started in 2002 in Iran to create a data bank for gully erosion in Iran (Soufi, 2004).

3. Methods

The regions with gully erosion area larger than 5 km² were determined using historical and anecdotal evidence and field surveying. The climate of gully regions was determined using Demarton's classification. In each climatic zone, two regions with gully erosion were selected and in each region at least three representative gullies were selected to determine fifteen variables. Six representative gullies were selected to measure their morphometric and soil characteristics in each climate zone. Measurements of top and bottom width and depth were done in the headcut, 25, 50 and 75% of gully length from headcuts. Soil samples were taken from those points. Viewplan, headcut plan and long profiles of the gullies were surveyed, using theodolite.

4. Results

The results of this research indicated that gully erosion was formed in two climatic zones including arid and mediteranean. Gully erosion is more extensive in the former climate than mediteranean one (Table 1). Factors such as intensive and short period rainfall, poor rangeland vegetation cover and chemical characteristics of soil were attributed for more gully area in the arid climate.

Table 1 Comparison the extent of gully erosion in different climates in Markazi province, central Iran

Climate	Representative Region 1		Representative Region 2	
	Name	Area (km ²)	Name	Area (km ²)
Cold desertic arid	Robat-e-tork	10.6020	Dodehak	5.8279
Very cold arid	Peik-e-zarand	11.3477	Shorak-abad, Zavieh	12.2731
Cold mediteranean	Solab	2.2519	Darband	1.4103
Mild mediteranean	Zahir-abad	4.5196	Dehkaied	1.8560

Comparison of morphometric and landuse characteristics of the regions with gully erosion in this province is shown in Table 2.

Higher sediment from gullies in Robat-e-tork and Solab regions has deteriorated the water quality. Damage to roads is observable in some regions such as Dodehak region. Gully erosion in the arid climate caused more damages to the rangeland. Due to the dephlation of soil moisture in rangeland, poor vegetation cover and less bio-mass are observable. Higher sediment concentration in rivers in the affected regions caused more damages to the aquatic life and river channel.

5. Conclusion

Gully erosion covers more area in the arid climate than humid one. Human impact, intensive and short period rainfall with soil chemical characteristics helped gully erosion to develop. In the arid climate, the gullies have dendretic general view plan. They are also longer and denser. It implies the surface runoff production by uplands. They are formed in the rangelands. In he humid climate, gullies are concentrated on the croplands. Their length, depth and width are less than those in the arid ones. Field observations indicated that no alternative controls for gully mitigation were applied in different climates in this province.

6. References

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Table 2 Some morphometric characteristics of the gullies, causes of gully formation and their activity in Markazi province

Region	Climate	Evolution	General view plan	Headcut plan	Drainage area above headcuts (ha)	Shape of cross section	Cause(s) of gully erosion	Gully activity
Robat-e-tork	Cold desertic arid	Discontinuous	Dendretic	Pointed-Rounded	8.17	Rectangle-Trapezoid	Changing rangeland to cropland	Very active
Dodehak	Cold desertic arid	Discontinuous	Dendretic	Pointed-Rounded	0.099	Trapezoid	Bridge construction and compaction	Very active
Peik-e-zarand	Very cold arid	Discontinuous	Dendretic	Notched	1.495	Trapezoid	Changing rangeland to cropland	Very active
Shorak-abad, Zavieh	Very cold arid	Discontinuous	Dendretic	Notched	1.88	Trapezoid-Compound	Landuse change and soil compaction	Very active
Solab	Cold mediteranean	Discontinuous	Dendretic	Rounded	1.3	Trapezoid	Landuse change and tillage in the direction of slope	Very active
Darband	Cold mediteranean	Discontinuous	Dendretic	Rounded	0.168	Trapezoid	Landuse change and tillage in the direction of slope	Very active
Zahir-abad	Mild mediteranean	Discontinuous	Linear	Notched-Pointed	3.481	Trapezoid	Road construction + cropland mosmangement	Very active
Dehkaied	Mild mediteranean	Discontinuous	Linear	Notched-Rounded	25	Trapezoid	Mis-management rain fed and irrigated farms	Very active